has attempted, and with real success, to show what manner of man Gilbert was, wherein lay his genius, what were his merits, and what also were his faults and failings. Mr. Benham dwells on the circumstance that, although Gilbert's actual discoveries were few and crude, he must be judged rather by the spirit of his work. "He was not the builder of sciences, but the architect of a truly scientific spirit; and his life-work consisted in the doctrine, new to England, that all scientific knowledge must be founded on practical experiment and observation alone, instead of upon speculations and theories evolved out of inner consciousness." The successive chapters of the book deal with the old magnetic philosophies, magnetic motions and electric force, the magnet's "directive virtue," the variation of the compass, the dip and "orbes of virtue" of the magnet, the life of the Universe (in which Gilbert, although no Manichean, was clearly a believer) and the Copernican theory. The author is particularly happy in his treatment of this last topic; but throughout the analysis of Gilbert's work is accurate and discriminating. The book is illustrated with a picture of Gilbert's terrella, and another of his tombstone in the church of Holy Trinity, Colchester. S. P. T.

The Vocal System based on the Fundamental Laws of Language. By G. Lionel Wright. Pp. 20. (Published by the Author, Upper Belgrave Road, Clifton, Bristol.) Price 1*s.* net.

IT is now recognised that teaching to read is not the simple matter which it was once thought to be. In recent years one system has followed another in rapid succession, and each has claimed in turn that by its introduction the time taken by the child to learn to read the mother tongue was much reduced. There seems to be a chance that these experiments may eventually reduce the difficulty of this first step in human education to a minimum. Mr. Wright proposes to make extensive use of the blackboard and of *vivâ voce* methods of instruction, and to start teaching the child to read by making him learn the five vowels. When this has been accomplished, the learner is introduced, by carefully graduated steps, to certain combinations of vowels and consonants, which are clearly indicated in this brochure, and by following which Mr. Wright claims that children may read at the age of six. A somewhat minute examination of the contents of the pamphlet leads us to think that Mr. Wright would be well advised in making his instructions to the teacher much more detailed and explicit if he is anxious that his system should become widely adopted, for at present the teacher will be, at several points, at a loss to know the next step in the course of work.

The Lake Counties. By W. G. Collingwood. (Dent's County Guides.) Pp. xii + 392; illustrated. (London: J. M. Dent and Co.) Price 4*s.* 6*d.* net.

THIS little volume—the fourth of the series to which it belongs—will be found invaluable to all who visit the Lake District. In addition to being an excellent guide, with a number of itineraries and many maps, it contains four chapters on the natural history of the district, the birds being described by Miss Armitt, the butterflies and moths by Canon Crewdson, the flora by Mr. S. L. Petty, and the geology by Prof. Hull. In the chapters on fox-hunting, angling and shooting, the sportsman will find abundant matter for interest, according to his particular taste. This volume fully maintains the high reputation of its predecessors, and is, in fact, all that a guide should be. Those tourists who wish to go more deeply into the natural history of one of the most interesting and beautiful districts in England will find all they want in the more pretentious volume by the late Mr. Macpherson entitled "Lakeland." R. L.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Symbol for Partial Differentiation.

PROF. PERRY'S difficulty (NATURE, May 15, p. 53) is without doubt a real one, and is deserving of serious consideration. In connection therewith the following extract from a paper at present passing through the press may be found interesting, at least on the historical side. It is in reference to a memoir of Jacobi's published in the year 1841 in the twenty-second volume of *Crelle's Journal*:—

"The subject of the notation of differential-quotients is then entered on at some length (pp. 320-323), and the decision made to use ∂ in the manner which soon afterwards came to be familiar. The insufficiency of this notation is not forgotten, however, although its advantages over the different devices of Euler and Lagrange are recognised, his illustrative example being the case of $\partial z/\partial x$ where z is a function of x and u, and u is a function of x and y. He puts the whole matter in a nutshell when he says that it is not enough to specify the function to be operated on and the particular independent variable with respect to which the differentiation is to be performed, but that it is equally necessary to indicate the involved quantities which are to be viewed as constants during the operation."

To this the following footnote is added:—

"I may state in passing that in 1869 when lecturing on the subject I found it very useful to write

$$\phi\overline{x, y, z} \ , \ f\overline{s, t, u, v} \ , \ \ldots .$$

in place of

$$\phi(x, y, z) \ , \ f(s, t, u, v) \ , \ \ldots .$$

and then indicate the number of times the function had to be differentiated with respect to any one of the variables by writing that number on the opposite side of the vinculum from the said variable; thus

$$\phi\overline{{}^{1}x, {}^{3}y, {}^{2}z}$$

meant the result of differentiating once with respect to x, thrice with respect to y, and twice with respect to z.

"Using this notation to illustrate Jacobi's example, we see that if it were given that

$$z = \phi\overline{x, u}$$

we should have

$$\partial z/\partial x = \phi\overline{{}^{1}x, u} \ ;$$

but that if it were given that

$$z = \phi\overline{x, u} \quad \text{and} \quad u = \psi\overline{x, y}$$

then we should not be certain as to the meaning of $\partial z/\partial x$, as it would stand for

$$\phi\overline{{}^{1}x, u} \text{ or } \phi\overline{{}^{1}x, u} + \phi\overline{{}^{1}x, u} \cdot \psi\overline{{}^{1}x, y}$$

according as u or y was to be considered constant."

Cape Town, S.A., June 5. THOMAS MUIR.

I AM glad to think that a pure mathematician sees the difficulty met with by users of mathematics. I wish that men who write to me privately would publish their remarks. One correspondent says: "I think 'the mathematicians' made a rather stupid blunder when they introduced ∂ for partial differentiation. This way: nearly all differential coefficients *are* partial; even a complete one (assumed complete) may become partial by extension of the field of operation. So an old investigation of Kelvin's, for example, using d throughout, is, by 'the mathematicians,' replaced by the same using ∂ throughout, except one or two here and there! What is the use? It gives a lot of trouble, and as printers haven't always ∂'s, or proper sized ∂'s, it makes bad work. It should have been ∂ itself that was introduced for the exceptional use, thus making next to no alteration in the classical investigations." These are, indeed, my own views, but as my pupils go forward to University examinations I

advise them to adopt the fashion which is likely to please the examiners.

In thermodynamics we cannot easily adopt Mr. Muir's suggestion. Take the simplest case of unit quantity of mere fluid. v, p, t, E and ϕ are such that they are all known if any two (except in certain cases) are known. Any one *may* be expressed as a function of any other two. My symbol $\left(\frac{dE}{dv}\right)_p$ is quite definite. But to adopt Mr. Muir's suggestion I must say:—

Let $E = f(v, p)$ then $f^1(v, p)$ is what my symbol means. Inasmuch as my letters stand for the same quantities irrespective of the letters of which they are functions, I use one letter E where on Mr. Muir's suggestion I must use E as $f(v, p)$ or $F(v, t)$ or $\psi(v, \phi)$ or $\chi(p, t)$ or $\theta(p, \phi)$ or $\xi(t, \phi)$ or six distinct symbols if I have to express any differential coefficient of E, and if I have to express all the differential coefficients of v I must use other six symbols; altogether I must use thirty of these curious symbols instead of five common letters, and, furthermore, I must keep them all in my head. JOHN PERRY.

The First Magnetician.

WHILE thanking you and "R. T. G." for the exceedingly kind appreciation of the Gilbert Club's English translation of "De Magnete" (p. 249), I write to express the wish that the notice had mentioned the names of those who have collaborated in the production of this version. They are the late Mr. Latimer Clark, the late Sir B. W. Richardson, Rev. A. W. Howard, Prof. R. A. Sampson, Dr. Joseph Larmor, Sec. R.S., Prof. Meldola, F.R.S., Mr. Edward Little, Mr. G. T. Dickin and Rev. W. C. Howell. To the last-named a special recognition is due for indefatigable and critical care during the long final revision and press correction.

July 14. SILVANUS P. THOMPSON.

"Fox-shark" or "Thrasher" (Alopecias vulpes) in the English Channel.

ON July 2 a fine specimen of this shark was captured several miles south of the Eddystone Lighthouse by fishermen in search of mackerel. The fish was taken at a depth of about 40 fathoms, and did a large amount of damage to the mackerel nets before it could be hauled on board and killed. The shark was brought to the Plymouth Museum and purchased for the collection.

It may be worth while to state that the spiracles, which Couch says he was unable to detect, are distinctly visible in this specimen. It is scarcely surprising that they should be sometimes overlooked, for though our fish is 13 ft. (thirteen feet) 7 in. (seven inches) long (of which the tail occupies seven feet), the spiracles are only 1/12th (one-twelfth) of an inch long by 1/16th (one-sixteenth) of an inch wide. Each is situated exactly 2½ (two and a half) inches behind the eye, and a line from the spiracle to the tip of the snout passes just above the centre of the pupil. E. ERNEST LOWE.

Plymouth Museum, Plymouth.

THE TRAMWAYS EXHIBITION AT THE AGRICULTURAL HALL.

THE International Tramways and Light Railways Exhibition which came to an end on Saturday last must be regarded as having been very successful from all points of view. The opening ceremony was performed by Mr. Gerald Balfour on July 1, and was accompanied by the usual luncheon and speeches. Mr. Gerald Balfour alluded, as might have been expected, to the recent deputation to his Department on the subject of electrical legislation, but he did not evince any sign of having become convinced of the necessity for speedy reform. In other respects the speeches were not of much interest; the same may be said to be true to a certain extent of the proceedings of the International Tramways and Light Railways Congress, which held its meetings on July 1 and 2. The Congress, which was the twelfth held by the Union internationale permanente de Tramways, was the first to be held in London; the papers read and discussed dealt with the management and technical details of tramway schemes, and were most of them contributed by the engineers or managers of continental tramways. Many of them were very valuable, especially as they were based on the results of wide practical experience, but we doubt if they would prove of great interest to the readers of NATURE.

The exhibition itself contained a number of very attractive exhibits. Although primarily a general exhibition of all things pertaining to tramways, there was much on view which was of the greatest interest to those having nothing to do with traction. It was also very noticeable that the exhibition resolved itself practically into one of electric tramways. Of course, there was much that was not electrical—such, for example, as rails, points, &c.—but these are all part of the equipment of an electrical system. And perhaps the general impression with which one left the hall, that a "tramway" was necessarily the same thing as an "electric tramway," was of more interest, as a sign of the times, than were any of the individual exhibits.

Several different types of car were on view; the one which, not unnaturally, attracted the most attention was that constructed by Messrs. Dick, Kerr and Co. for the London County Council. This is the first of one hundred cars being built for the Council's South London Tramways. The car is double-decked, and has a total seating capacity of sixty-six (twenty-eight inside and thirty-eight outside), and is equipped for the conduit system to be used on the South London lines. The Westinghouse Company exhibited a car which ran over a fully equipped trolley line laid along the total length of the hall, a distance of more than 300 feet. Power was obtained for running this from a 75 kw. direct-current generator (500 volts), driven by a Westinghouse three-cylinder gas engine. The car was fitted with the Westinghouse magnetic brake. This brake has a triple action, acting as a wheel-brake, a track-brake and an axle-brake; it is energised by current derived from the car motors, which work as generators whilst the car slows down, the necessary energy being derived from the momentum of the car. The action of the brake is therefore independent of the main current supply.

A notable feature of the exhibition was the Bremer arc lamp, exhibited by the Westinghouse Company. This lamp was used for part of the lighting at the Natural History Museum on the occasion of the Institution of Electrical Engineers' conversazione. Unfortunately, it did not create a very favourable impression there, as the lamps kept flickering; those at the Agricultural Hall seemed to be burning much better. The carbons used in the Bremer lamp are saturated with certain minerals which volatilise and become incandescent in the arc; they are, moreover, arranged nearly parallel to one another instead of vertically one above the other; the ends project a little below a protecting hood, meeting at an angle of about 20°, and the arc is kept at the tips by means of a magnetic deflecting device. The position of the arc, the materials used in the composition of the carbons, and the reflecting power of the conical hood, combine to produce a highly efficient light. It is said that the lamp is three times as efficient as an ordinary arc. The colour of the light is also much pleasanter and warmer than that of the ordinary arc, and the light appears to fill the globe much better, with the result that it produces somewhat the effect of a golden ball of light.

Another similar arc lamp exhibited was that of the Union Electric Company. This, which is called the "Flame" arc lamp, has vertical carbons like an ordinary lamp; the carbons are, however, cored with a mixture of certain fluorides, and the upper one passes through a